

One of the first things astronauts noticed when they started orbiting Earth in the 1960s was how many fires were burning in forests around the world. By the 1980s, Earth-observing satellites had showed that something is always burning somewhere on the planet.

Today's NASA satellites find fires as they start, observe how they burn, and map the scars they leave behind. Between 2003 and 2016, NASA's Aqua and Terra satellites detected 13.3 million fires. That's more than 1 million every year!

An astronaut snapped this photo of a towering pillar of smoke from the Ferguson Fire in California. The hotter a fire burns, the higher the smoke can go. The higher the smoke goes, the farther it can travel.



Finding the Heat

Satellites like Terra, Aqua, and Suomi NPP detect heat with their infrared sensors. Such heat signals can sometimes be the first clue to scientists and firefighters that a fire is burning. This is especially important in remote and sparsely populated places like the Australian Outback, northern Canada, Siberia, and Alaska, where a fire can go unnoticed because there are few people nearby to see or smell it. The satellite image below shows fires surrounded by ice in remote Siberia in April 2019.



Finding Fires Today

Satellite images are useful to firefighters and emergency managers as they try to figure out where to deploy people, fire trucks, and planes and to assess what areas suffered the most damage. Scientists use fire maps to better understand how fire spreads and how one year compares to others. The Fire Information for Resource Management System (FIRMS) lets citizens explore where NASA satellites have detected fires. Are there any fires near you? Take a look today by visiting <https://firms.modaps.eosdis.nasa.gov/map>

Smoky Skies

As **wildfires** burn, they make smoke. Anyone who has been near a campfire knows that smoke can irritate your lungs, and for some people this can be very dangerous. NASA satellites track smoke as it rises through the atmosphere and blows hundreds of miles with the wind. Views from above help scientists forecast air pollution in areas near and far from the fires. They also help scientists study how fires and smoke affect Earth's climate. This satellite image shows how smoke from the November 2018 Camp Fire degraded the air quality in San Francisco, 200 miles away.

November 9, 2018



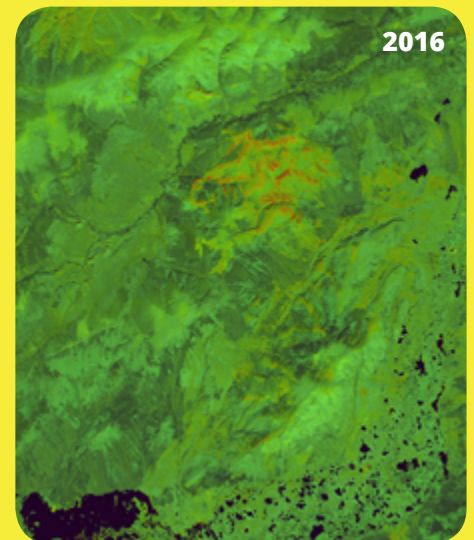
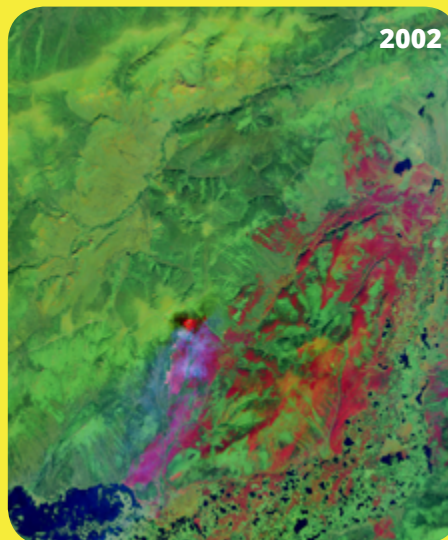
Scorched Scars

Satellites can see burn scars: where fires burned the land, destroyed vegetation and property, and left behind scorch marks. Once a fire is completely extinguished, scientists can examine the scar to see how forests and fields are healing over time.

Some forests actually need fires to stay healthy because they clear out dead trees and fallen branches that prevent seedlings from getting enough sunlight. Fire can help some species of trees drop their seeds. Other forests require some assistance from people. Botanists, biologists, and **silviculturists** figure out where to plant trees and what type in order to restore forests after a fire.

Can You See It? Now You Don't

This isn't a magic trick. These images show an area of Alaska that burned in a 2002 wildfire. Scientists combine different wavelengths of reflected infrared light to show the contrast between healthy vegetation in the forest to the bare ground after the fire. In 2002, the burn scar is bright red surrounded by healthy forest colored green. By 2016, the scar is mostly green, though it is lighter because the new forest has different vegetation than the older one that burned.



Vocabulary

Silviculturist – a person whose job is to help trees and forests grow and stay healthy.

Wildfire – a large, destructive fire that spreads quickly over forests, shrubs, or grasslands.

People Cause Most U.S. Wildfires

While lightning can ignite fires, almost 85 percent of all wildfires in the United States are caused by humans. People start fires by discarding cigarettes or leaving campfires unattended. They also sometimes lose control of fires that are set to clear crops or brush ("prescribed burns"). Wildfires can start from power lines, sparks from railroads, popped tires, lawnmowers and cars, or arson.

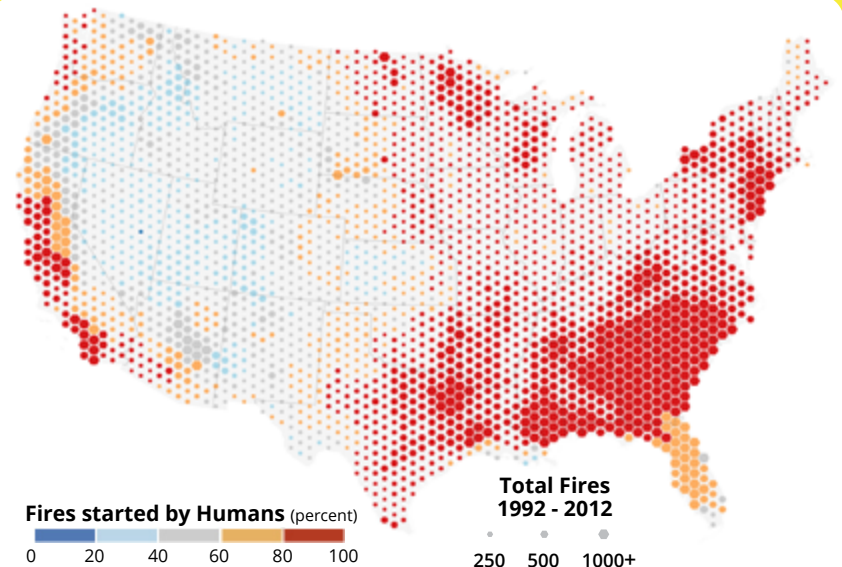


Larch trees in Siberia are fire resistant. Their bark, which can be up to 6 inches thick, protects them during a fire.



Credit: Clarity on Flickr, cc-by-2.0

These black spruce cones rely on wildfires to open and release seeds.



East or West? Where do Fires Burn Best?

Dense evergreen trees like pine, fir, and spruce, grow in boreal forests in far northern Eurasia and North America. Even though the forests are similar on both continents, they burn very differently. Trees in Eurasia have adapted to be fire resistant, while trees in North America have adapted to regrow quickly after a fire. Some types of North American trees, like the black spruce, need fire to release seeds.

Meow!

In Australia, scientists found that some wild cats travel to burned areas to hunt. After a fire, the tall grasses may be gone, leaving mice and other rodents without a place to hide. This makes it easier for the cats to find food.



On December 5, 2017, NASA pilot Donald "Stu" Broce shot this photograph of smoke streaming from intense wildfires in Southern California. NASA flies airplanes equipped with scientific instruments to learn about wildfires.

Data Viz Flipping through Yellowstone Fire Recovery

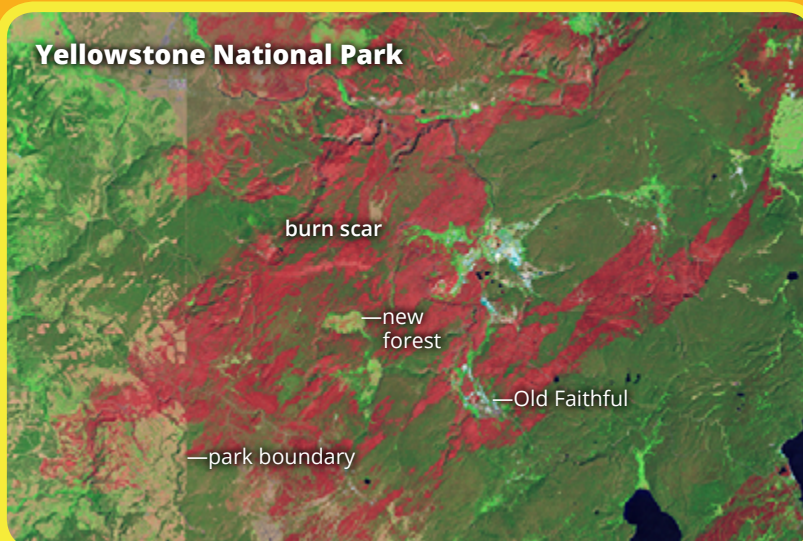
In the summer of 1988, lightning- and human-caused fires blazed through Yellowstone National Park. Fifty separate fires were ignited and seven of them became major wildfires. By September, 793,000 of the park's 2,222,000 acres had burned before being extinguished by the first snowfall. This series of images shows the burn scars from the western Yellowstone fires and the slow recovery that followed.

Materials

- binder clip
- scissors
- cardstock
- color printer

Make a Flipbook Animation

1. Print the flipbook on cardstock and cut along the dotted lines.
2. Stack the 32 flipbook frames in order.
3. Clip the stack of frames together with the binder clip.
4. Flip through the stack quickly and watch the animation.



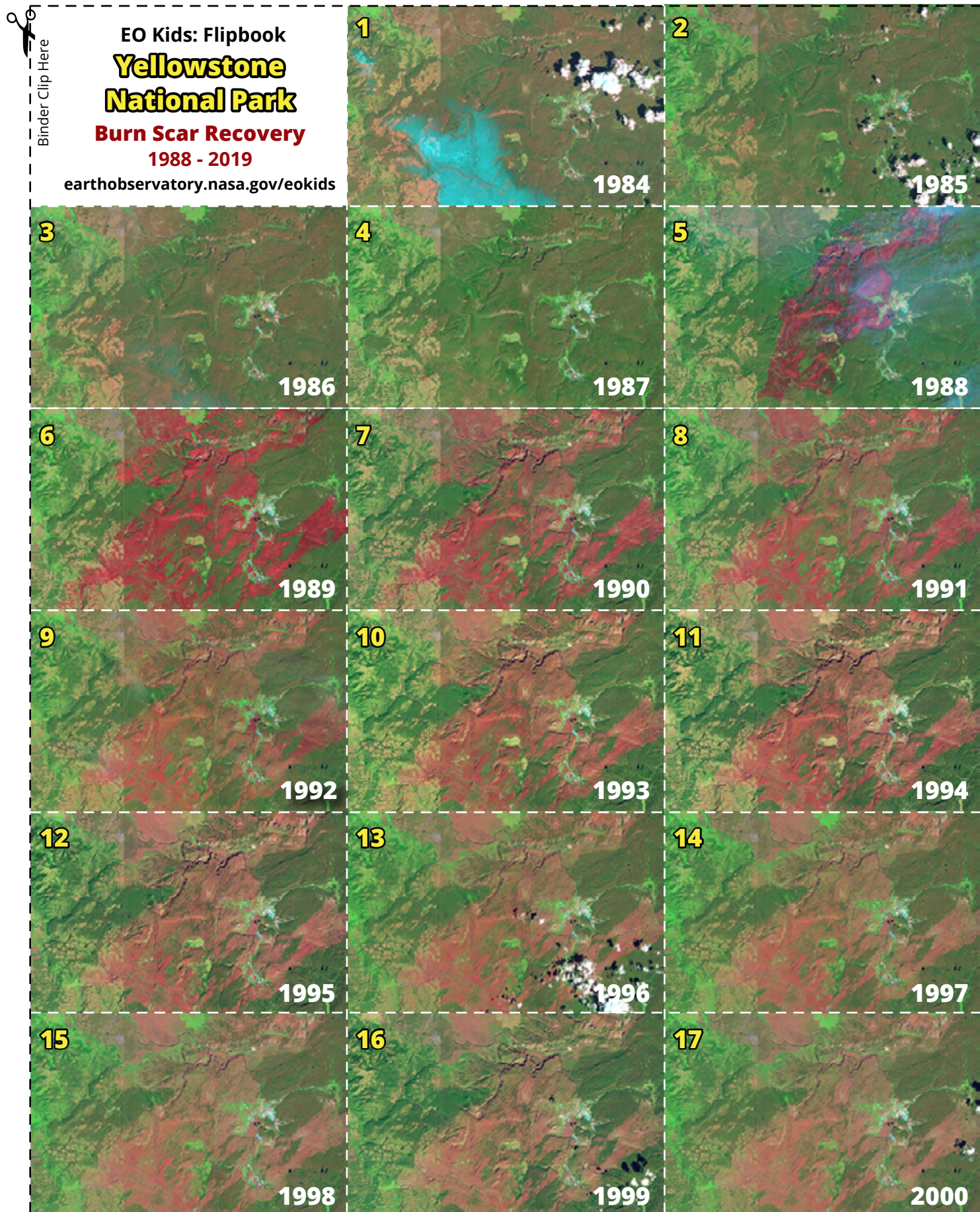
In these images, the burn scars are shown in red so you can easily see the areas that have burned. Older forested areas are dark green and younger forests appear light green. Scientists refer to this as primary forest and secondary forest, and the cycle of recovery is called succession.






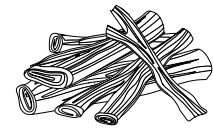



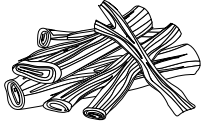








Questions

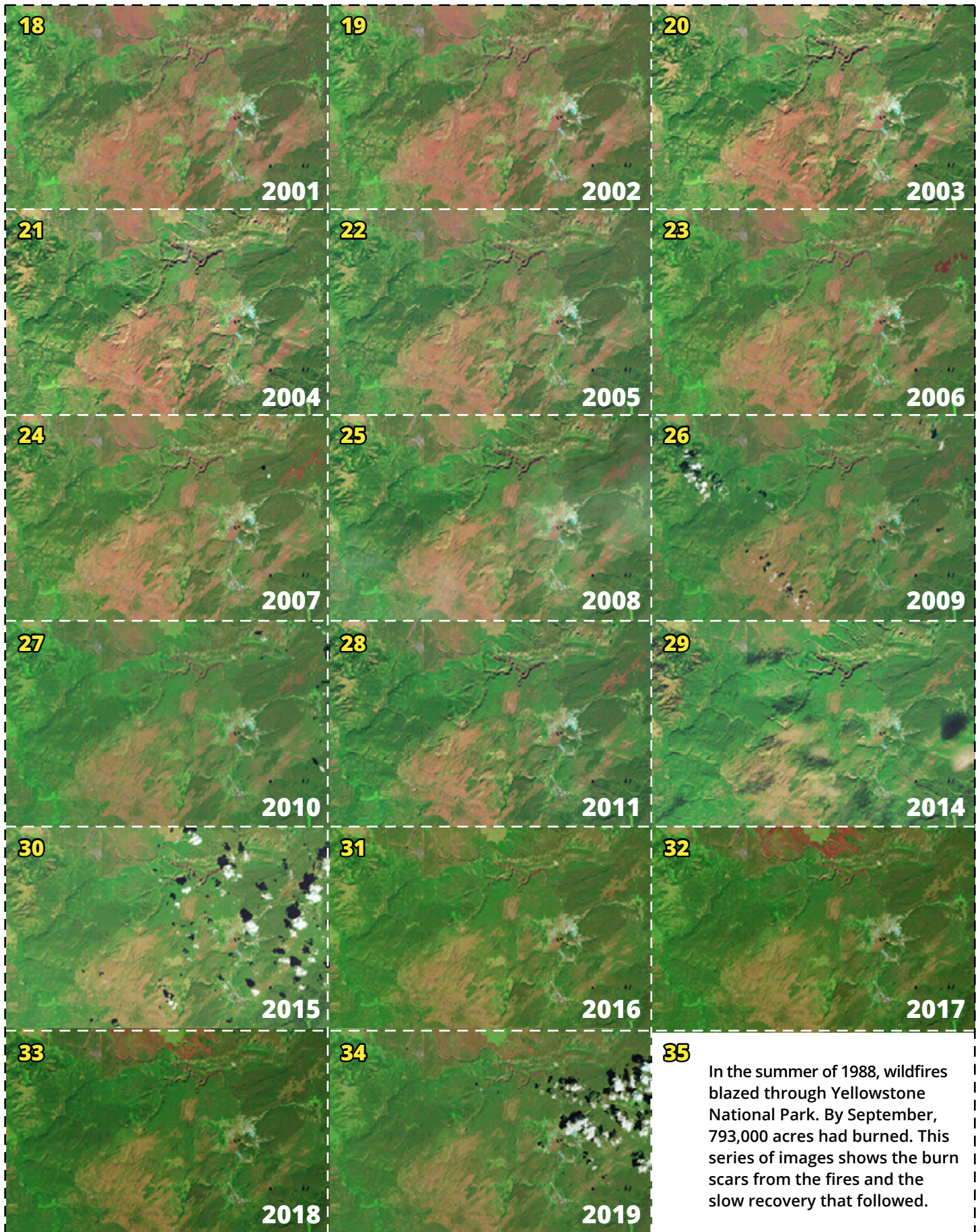
1. In what years since 2000 did new fires start in this area of the park?
2. Is the burned area still visible in 2019?

Where There's Smoke, There's Fire!

Make your own data visualization of wildfire damage in Yellowstone National Park.



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|---|---|--|
|  34 |  35 | Never leave a campfire burning. Make an animation showing how you would put out a fire.  |
|  31 |  32 |  33 |
|  28 |  29 |  30 |
|  25 |  26 |  27 |
|  22 |  23 |  24 |
|  19 |  20 |  21 |



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